



Effect of tree leaf as supplementation on nutrient digestion and rumen fermentation pattern in sheep grazing semi-arid range of India – II

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Abstract

A study was conducted to evaluate the effects of supplementing with different tree leaves on nutrient digestion, rumen fermentation and blood parameters of sheep. Thirty adult Malpura rams (39.0 ± 0.56 kg) were divided into five groups of six each. They were grazed as a single flock on a semi-arid rangeland and after the end of routine grazing period (08:00–17:00 h), first group (G1), which was not provided with any supplementation, served as control group. Second group (G2) was supplemented with 200 g of a conventional concentrate mixture per head per day, whereas third, fourth and fifth groups (G3, G4 and G5) were supplemented with approximately 200 g dry matter (DM) per day freshly cut foliage from *Ailanthus excelsa*, *Azadirachta indica* and *Bauhinia racemosa*, respectively. Protein content (g kg^{-1} DM) in *A. excelsa*, *A. indica* and *B. racemosa* foliage was 197, 128 and 132, respectively. *A. indica* and *B. racemosa* foliages also contained 123.2 and 211.2 g kg^{-1} DM condensed tannin (CT) with protein precipitating capacity (PPC) of 16.5 and 46.5 g kg^{-1} DM. None of the tree leaves contained hydrolysable tannin (HT). Dry matter intake (DMI, g day^{-1}) was 591, 766, 865, 974 and 939 in G1, G2, G3, G4 and G5, respectively. Digestible crude protein (DCP) and metabolisable energy (ME) intakes in supplemented groups G2–G5 were higher ($P < 0.05$) compared to control (G1). Supplementation improved digestibility of all nutrients in all groups. Rumen fermentation study indicated lower ($P < 0.05$) ammonia and total N in the rumen liquor collected from G5 sheep compared to the other supplemented groups. Although haemoglobin (Hb, g dl^{-1}) levels showed small changes among groups, blood urea nitrogen (BUN, mg dl^{-1}) was lowest in G5 compared to the other groups. Initial BW were similar among the groups. After 60 days of experimental feeding, all animals maintained their BW, except sheep in the control group (G1), which lost BW. Results indicate that for adult sheep grazing on a semi-arid range, supplementation with a concentrate mixture could be replaced by tree leaves like *A. excelsa*, *A. indica* and *B. racemosa*, during the lean season to maintain their BW. In addition, supplementing with tree leaves containing condensed tannin has advantages in terms of N utilization. © 2005 Elsevier B.V. All rights reserved.

Keywords: Rangeland; Tree leaves; Sheep; Rumen fermentation; Tannin contents

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1. Introduction

During long dry season in arid and semi-arid regions of India, productivity of small ruminants goes down drastically due to poor quality of native grasses and straws as well as shortage of good quality feed. Increasing demand and subsequent high cost of conventional animal feed ingredients has created the need for sustainable alternatives, particularly natural feed resources indigenous to this region. This search for alternative feed resources has rekindled research interest in the use of browse plants as sources of nutrients for small ruminants. Use of browse sources in ruminant feeding is hindered in many cases, due to the presence of tannins (Silanikove et al., 2001). It was established that there is an inverse relationship between high tannin level in forage and their palatability, voluntary intake, digestibility and N retention in ruminants (Silanikove et al., 1996).

In India, semi-arid regions of Rajasthan is inhabited by various fodder trees like *Prosopis cineraria*, *Acacia nilotica*, *Albizia lebbek*, *Ailanthus excelsa*, *Azadirachta indica* and *Bauhinia racemosa*. Adverse effects of tree leaves when fed as a sole diet have been reported in sheep (Prasad et al., 1997) and goats (Bhatta et al., 2002a,b). However, goats are reported to be more tolerant to tannin than sheep (Silanikove et al., 1996). Treatment of tannin-rich trees/shrub leaves with binders (like polyethylene glycol (PEG)) has been suggested as a means to enhance their nutritive value and animal productivity, but cost is the limiting factor. Although tannins are generally regarded as anti-nutritional, certain type/kinds of tannins at low concentrations are known to be beneficial to the ruminants (Barry and Duncan, 1984). Supplementation of tannin containing leaves appears to be the only viable means for the utilization of such leaves under semi-intensive system of sheep rearing. In this study, the supplementation with tree leaves was aimed at envisaging three important objectives: first, to compare supplementation with tree leaves devoid of tannin as well as those containing tannin with that of standard/conventional concentrate mixture; second, to compare supplementation of tree leaves devoid of tannin with that of leaves containing condensed tannin (CT) and; third, to compare effect of supplementing tree leaves containing two different levels of CT on the performance of grazing sheep.

This information is very much essential for efficient incorporation of tree leaves into the current small ruminant feeding system in the semi-arid region.

2. Materials and methods

2.1. Study area

The present study was conducted on a native range located at Central Sheep and Wool Research Institute, Avikanagar, India (75°28'N latitude and 26°17'E longitude, 320 m elevation). The climate is typically semi-arid with yearly mean minimum and maximum temperatures of 8.0 and 41.5 °C and 275 mm annual precipitation.

2.2. Rangeland

Rangeland at the experimental station was occupied by a heterogeneous vegetation of shrubs with an annual herbaceous undergrowth. The undergrowth was occupied by *Cenchrus ciliaris*, *Melilotus indica*, *Crotalaria burhia* and *Indigofera cardifolia* grass and forb species. *P. cineraria*, *A. excelsa*, *A. indica* and *B. racemosa* were the dominant shrub species. Semi-arid vegetation is characterized by a lush green and dense pasture during monsoon, long and stalky in winter and dry during summer. During our study period (January–February), ground vegetation was in a matured state.

2.3. Animal study

Thirty adult Malpura rams of comparable BW (39.0 ± 0.56 kg) were divided into five groups of six each. They were grazed as a single flock from 08:00 to 17:00 h with provision of clean drinking water twice a day. During this period, they were not provided with any lopped tree foliages while grazing. After the end of grazing period, they were divided into five groups. First group (G1), which was not provided with any supplementation served as control sheep; second group (G2) was supplemented with 200 g of concentrate per head. The concentrate mixture was from a commercial source of known composition in mash form containing (parts) corn (12), barley (15), broken wheat (15), wheat bran (25), de-oiled rice bran (20), groundnut cake (10), mineral mixture (2) and common salt (1). It contained

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